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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/661,130	09/12/2003	Mark Visokay	TI-35942	7761
23494	7590	08/05/2004	EXAMINER	
TEXAS INSTRUMENTS INCORPORATED P O BOX 655474, M/S 3999 DALLAS, TX 75265			MALSAWMA, LALRINFAMKIM HMAR	
			ART UNIT	PAPER NUMBER
			2825	

DATE MAILED: 08/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/661,130	Applicant(s) VISOKAY ET AL.	
	Examiner Lex Malsawma	Art Unit 2825	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Sep. 12, 2003 through Dec. 11, 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 24-26 is/are allowed.
- 6) ☒ Claim(s) 1,15-17,27 and 32-35 is/are rejected.
- 7) ☒ Claim(s) 2-14,18-23 and 28-31 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>20031211</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).
3. Claims 1, 15-17, 27 and 32-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koyama et al. (US 2003/0122199 A1; hereinafter, "**Koyama**") in view of Chau et al. (5,625,217; hereinafter, "**Chau**").

Regarding claim 1:

Koyama discloses a method of fabricating PMOS and NMOS metal gate structures in a semiconductor device, the method comprising:

forming a gate dielectric 7 in PMOS and NMOS regions above a semiconductor body (Figs. 1, 2 and 4);

forming a metal **silicide** 11 above the gate dielectric in the NMOS region (Fig. 2 and paragraph 0096);

forming a metal boride 8 above the gate dielectric in the PMOS region (Fig. 1 and paragraph 0091);

patterning the metal **silicide** 11 to form an NMOS gate structure in the NMOS region (Fig. 4, note region "2"); and

patterning the metal boride 8 to form a PMOS gate structure in the PMOS region (note region "1" in Fig. 4).

Koyama **lacks** utilizing a metal nitride instead of the metal **silicide** 11 in the NMOS region. Chau **teaches** it was well known in the art that a gate structure similar to the NMOS structure disclosed by Koyama can be form with *either* metal silicide *or* metal nitride. Chau discloses a method of forming an NMOS structure (Figs. 4A-4G) comprising a conductive layer 504, similar in material-and-function with the metal silicide layer 11 of Koyama, wherein Chau specifically discloses suitable materials for the conductive layer 504 include metal nitride (TiN) and metal silicide (note Chau, Col. 4, lines 23-28). Given Chau, it would have been obvious to one of ordinary skill in the art to modify Koyama by utilizing a metal nitride instead of the metal silicide 11 because Chau teaches/shows that a metal nitride was just one of a plurality of known materials suitable for use (in an NMOS structure) in a manner similar to that disclosed by Koyama. In other words, the only essential modification of Koyama necessary to arrive at the currently claimed invention would be to replace the metal silicide 11 with a known, suitable material such as a metal nitride. Such a modification is held obvious, especially since it has been held to be within the general skill of a worker in the art to select a known material on the basis of

its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Regarding claims 15-17:

Chau discloses the metal nitride would be titanium nitride (TiN, note Col. 4, lines 23-28) and Koyama discloses the metal boride is TiB₂ (note Koyama, paragraph 0121); therefore, Koyama in view of Chau renders obvious the metal nitride being TiN and the metal boride being TiB₂.

Regarding Claim 27 and 32:

These claims are directed to a device acquired by the method of claims 1 and 17, therefore, they are held obvious over the cited references with reasoning similar to those applied above, i.e., all limitations within these claims are disclosed or rendered obvious by Koyama in view of Chau.

Regarding claims 33 and 34:

Koyama discloses a conductive upper material (9, 12) comprising poly-silicon formed above the metal silicide structure and the metal boride structure (note Figs. 1-2); therefore, these claims are held obvious over Koyama in view of Chau.

4. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Koyama** (in view of **Chau**) as applied to claim 33 above, and further in view of Wakabayashi et al. (6,483,151 B2; hereinafter, "**Wakabayashi**").

Regarding claim 35:

Koyama (in view of Chau) **lacks** the conductive upper material being tungsten.

Wakabayashi is **cited only to show** it was well known in the art that a CMOS structure similar to that disclosed by Koyama could be formed with a conductive upper material that is tungsten.

Wakabayashi discloses (in Fig. 2) a CMOS structure similar to that in Koyama, wherein Wakabayashi utilizes a metal nitride layer 106 (of TiN) in a manner similar to that disclosed by Chau; and Wakabayashi discloses that tungsten 106 can be used for the conductive upper material (note Col. 8, lines 26-33). It would have been obvious to one of ordinary skill in the art to modify Koyama (in view of Chau) by specifically using tungsten for the conductive upper material because Wakabayashi shows that tungsten was well known and utilized in such a manner. In other words, given Wakabayashi, one of ordinary skill in the art would have readily recognized that tungsten is a suitable material replacement for Koyama's polysilicon.

Accordingly, replacing Koyama's polysilicon with tungsten would have been an obvious matter of selecting a known material on the basis of its suitability for the intended use. *In re Leshin*, 125 USPQ 416.

Allowable Subject Matter

5. Claims 24–26 are allowable over the references of record.
6. Claims 2-14, 18-23 and 28-31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter:

Claims 2-14 would be allowable primarily because the references of record cannot fairly suggest the process for forming the metal boride specified in claim 2 in combination with the limitations in claim 1.

Claims 18-23 would be allowable primarily because the references of record cannot fairly suggest the process for forming the metal nitride specified in claim 18 in combination with the limitations in claim 1.

Claims 24-26 are allowable primarily because the references of record cannot anticipate or render obvious the limitation (in combination as recited in claim 24) of changing the starting material to provide a metal nitride in the PMOS region and a metal boride in the NMOS region.

Claims 28 and 29 would be allowable primarily because the references of record cannot fairly suggest the metal boride being specifically a metal nitride material doped with boron.

Claims 30 and 31 would be allowable primarily because the references of record cannot fairly suggest the metal nitride being specifically a nitrided metal boride.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The references listed on the attached Form PTO-892 (not specifically cited above) are cited to show methods for forming CMOS structures incorporating metal nitride, metal boride, etc.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lex Malsawma whose telephone number is 571-272-1903. The examiner can normally be reached on Mon-Fri (6AM-2PM EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Lex Malsawma



July 30, 2004



MATTHEW SMITH
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